

[0051] In addition to the non-visual display, it is preferable to allow a visually impaired user to interact with the representation to receive more detailed information about content in a given area. Preferably, by tapping one area in the representation, the content of this area is loaded into a linear screen reader. Allowing an indicated area to be loaded eliminates the need of the user to linearly navigate the entire page via the reader to reach the one frame the user is interested in. In addition, or alternatively, a non-visual representation of the content of the area is generated by providing vibratory or auditory feedback for objects contained in the web page, which provides information about the object. Generally, however, the non-visual representation of the content is limited to salient objects due to the limited tactile resolution of users. Interface component 116 then displays this content representation to the user via touch pad 108. Via the linear reader and/or the non-visual representation of the content, the user can view the content in more detail; interact with specific objects on the page, such as forms; or request new pages by following hyperlinks on the web page.

[0052] To provide for interaction with the non-visual, abstract representation in the above manner, when a user taps an area 410 of touch pad 108, interface component 112 maps the coordinates of the finger's position 412 to the coordinates of the non-visual, abstract representation. Preferably, interface component 116 generates auditory feedback 414 to acknowledge the request and then generates the request for area content 416. This request is sent 418 to intermediary 112.

[0053] When a user interaction with interface component 116 results in a content request, or when interaction with the browser, linearized content, or non-visual content representation results in a request for a new web page, the request is sent to intermediary 112, which processes the request. FIG. 5 diagrammatically illustrates the steps performed when intermediary 112 receives a request from interface component 116. When the request is one for a new web page, intermediary 112 requests the new web page from the appropriate Web server, receives the web page data and processes it as described in conjunction with FIG. 3a. When the request, however, is for the content of an area, intermediary 112 retrieves the content for the area requested from the intermediary cache, where it was stored when the web page data was received by intermediary 112. This content is then transmitted to the linear reader. In addition, or alternatively, intermediary 112 processes the content to generate a non-visual representation of the content by associating vibratory or auditory feedback with objects of the content and generating data of the spatial layout of the objects. This non-visual representation is then transmitted to interface component 116.

Conclusion And Alternate Embodiments

[0054] As previously described, the present invention is not limited to the hardware described in the preferred embodiment. For example, the tactile stimulator array described in U.S. Pat. No. 5,736,978 may advantageously be used in the present invention to provide the tactile feedback. As another example, FIG. 6 depicts the use of the present invention with a large-scale projector 600 and a laser pointer 608. Use with projector 600 and pointer 608 facilitates a visually impaired user in giving a presentation.

Laser pointer 608 is used to point a beam of light 610 towards the surface of large scale projector 600, which has a multi-part information page visually and non-visually, or alternatively, just non-visually displayed thereon. The multi-part information page has a number of spatially located areas of separate content 602, 606, and 604. A user navigates the multi-part information page by directing light beam 610 from laser pointer 608 towards projector 600. Projector 600 includes photo-detectors for determining input position coordinates of light beam 610 on projector 600. These input position coordinates are mapped to a non-visual, abstract representation of the multi-part information page. When input position coordinates of light beam 610 crosses the coordinates of the boundaries separating areas of content 602, 606 and 604 in the non-visual, abstract representation, a signal is sent wirelessly to pointer 608, causing pointer to provide vibratory feedback to the user. In addition, when input position coordinates of light beam 610 are in areas of content 602, 602 and 606, auditory feedback representative of content meta-information is provided by an auditory output device. By providing the non-visual feedback of the multi-part information page layout, a visually impaired user is guided in using laser pointer 608 when giving a presentation.

[0055] Further, in other embodiments within the scope of the present invention, the tactile feedback is divorced from the input device. Rather, the tactile feedback is provided through another separate device in contact with a portion of the user's body. For instance, a necklace, bracelet or ring worn by the user would receive the feedback commands from interface component 116, transmitted, e.g., by a wireless transmission system. The necklace, bracelet or ring would then generate vibratory or other tactile feedback in response to the received commands.

[0056] In addition, a touch pad is used in the preferred embodiment as it can provide for a stationary input device and is closely analogous to a visual display screen. Also, the physical position of the user's finger directly corresponds to the "cursor" input position. This allows the physical locations that generate feedback to remain static. However, other devices providing absolute positioning, such as a digitizer pad where physical location of a mouse is detected and directly corresponds to a cursor input location, are also envisioned within the scope of the present invention. Additionally, input devices providing relative positioning, where physical position does not necessarily directly correspond to the cursor input position, may be used, however, their use may cause a sense of dislocation and confusion to the visually impaired user. Similarly, other forms of tactile feedback than vibratory and other appropriate auditory feedback, such as vocalizations, are also envisioned within the scope of the present invention.

[0057] It should also be noted that, while the preferred embodiment of the present invention is particularly suited to operate with web pages and is described in conjunction therewith, other GUIs provide similar environments for interaction via comparable multi-part information pages. For example, the "help" features currently available for many computer applications, such as Microsoft® Word 2000, displays separate content simultaneously in different spatially located areas of the screen to create navigation tools/search facilities for the help database. Therefore, the present invention is not limited to web pages, and the non-visual